

Assessment of Improvement in Heat Exchangers Behaviour Using Ice Slurry As Secondary Refrigerant

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Ice slurry is well known as a biphasic secondary refrigerant that presents several potential advantages compared to single phase secondary refrigerants. These potential advantages can be summarized in the ability to use the thermal storage, and the high cooling capacity given by the latent heat. Theoretically, these features must allow important energy savings in secondary refrigerant distribution loop. An accurate evaluation of these energy savings requires knowledge of the thermal and rheological behaviour of the refrigerant studied. Based on the experimental model developed by the authors for brine-based ice slurry, a theoretical analysis of heat exchanger behaviour is presented in this work in order to find out the potential energy savings associated with its use. The influence of ice concentration, mass flow rate, heat exchanger length and pipe outer wall temperature over pumping power and heat transfer rate is studied. The ratio between heat transfer rate and pumping power is used as the evaluation parameter, which allows determination of the most favourable operation conditions for ice slurry flow. In order to assess the improvement obtained using ice slurry, results for ice slurry are compared to those obtained for a carrier fluid at the same inlet temperature. Finally, a practical example is proposed where the behaviour of a facility with several heat exchangers working in series is analysed for ice slurry and single phase flow.